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Mr. John Grantham  
State of Washington  
Department of Ecology  
Nuclear & Mixed Waste Program  
P. O. Box 47600  
Olympia, WA 98504-7600

FLUOR DANIEL, INC.

Date: AUGUST 1, 1991

Reference: Hanford Waste Vitrification Plant  
DOE Contract DE-AC06-86RL10838  
Fluor Contract 8457

Transmittal No.: WDOE-056 R1

Dear Mr. Grantham:

## TRANSMITTAL

We enclose 2 copy of the items listed below. These are issued per US-DOE request.

Response due to Fluor: N/A

Responds to: PKG A150.02 MILESTONE K739

NUMBER	Rev.	Date	TITLE
B-595-C-A150	1	07/30/91	AREA SECURITY LIGHTING
			<u>PLEASE REPLACE THIS SPECIFICATION. WITH THE PREVIOUS SPECIFICATION SENT ON AUGUST 1, 1991.</u>

### Distribution:

REFERENCE: FRP-262 R1, FUP-046 R1  
R. L. Long: DOE-RL W/O  
VPO/AME Corresp Cntrl Cntr, MSIN A5-10  
(PKG A150) w/O  
P. Felise, WHC-RL (MSIN G6-16) w/1  
Environmental Data Management Center  
(MSIN H4-44) w/1  
D. Duncan, US EPA, Region X w/O

Very truly yours,



R. S. Poulter  
Project Director

RSP:ERJ:vli

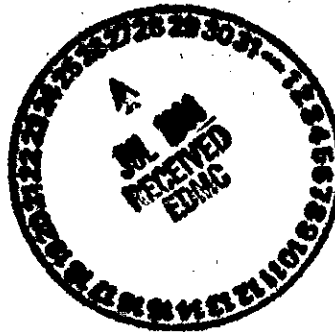


943151-000

# SPECIFICATIONS

**AREA SECURITY LIGHTING**

**B-595-C-A150**



## **HANFORD WASTE VITRIFICATION PLANT**

**U.S. DEPARTMENT OF ENERGY  
RICHLAND OPERATIONS OFFICE**



**FLUOR DANIEL  
ADVANCED TECHNOLOGY DIVISION  
CONTRACT 8457**

**DOE CONTRACT NO.  
DE-AC06-86RL10838**

U.S. DEPARTMENT OF ENERGY  
Hanford Waste Vitrification Plant  
Richland, Washington  
DOE Contract DE-AC06-86RL10838

FLUOR DANIEL, INC.  
Advanced Technology Division  
Fluor Contract 8457

AREA SECURITY LIGHTING  
SPECIFICATION B-595-C-A150

"RELEASED FOR CONSTRUCTION"

REVISION NO. 1  
SAFETY CLASS 4  
ISSUE DATE \_\_\_\_\_

APPROVED BY:

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E. R. Jacobs Project Package Engineer

7-30-91  
Date

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7/30/91  
Date

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AREA SECURITY LIGHTING  
(B-595-C-A150)

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**SECTION 01730  
OPERATION AND MAINTENANCE DATA**

**PART 1 GENERAL**

**1.1 SUBMISSION OF OPERATION AND MAINTENANCE DATA**

Submit operation and maintenance (O&M) data which is specifically applicable to this Seller's scope of work and a complete and concise depiction of the provided equipment or product. Data containing extraneous information to be sorted through to find applicable instructions will not be accepted. Present information in sufficient detail to clearly explain user O&M requirements at the system, equipment and component level. Include an index preceding each submittal. Submit in accordance with Part III, Section I, Exhibit 5 of the Purchase Order/Subcontract, Vendor Drawing and Data Requirements (VDDR).

**1.1.1 Package Content**

For each product, system, or piece of equipment requiring submission of O&M data, submit the package required in the individual technical section. Package content shall be as required in the Paragraph 1.3, "Schedule of Operations and Maintenance Data Packages."

**1.2 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES**

**1.2.1 Operating Instructions**

Include specific instructions, procedures, and illustrations for the following phases of operation.

**1.2.1.1 Safety Precautions**

List personnel hazards and equipment or product safety precautions for all operating conditions.

**1.2.1.2 Normal Operations**

Include control diagrams with data to explain operation and control of equipment.

**1.2.1.3 Service Requirements**

Include instructions for services to be performed such as adjustments and inspection.

1.2.1.4 Environmental Conditions

Include a list of environmental conditions (temperature, humidity, and other relevant data) which are best suited for each product or piece of equipment and describe conditions under which equipment should not be allowed to operate.

1.2.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair.

1.2.2.1 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance and inspections required to ensure proper and economical operation and to minimize corrective maintenance and repair. Provide manufacturer's projection of preventive maintenance man-hours on an annual basis.

1.2.3 Corrective Maintenance

Include manufacturer's recommendations on procedures and instructions for correcting problems and making repairs.

1.2.3.1 Troubleshooting Guides and Diagnostic Techniques

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.2.3.2 Wiring Diagrams and Control Diagrams

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams number electrical and electronic wiring and the terminals for each type, identically to actual installation numbering.

1.2.3.3 Maintenance and Repair Procedures

Include instructions and list tools required to restore product or equipment to proper condition or operating standards.

1.2.3.4 Removal and Replacement Instructions

Include step-by-step procedures and list required tools and supplies for removal and replacement of components, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

1.2.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays.

1.2.3.6 Corrective Maintenance Man-Hours

Include manufacturer's projection of corrective maintenance man-hours. Corrective maintenance that requires participation of the equipment manufacturer shall be identified and tabulated separately.

1.2.4 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.2.4.1 Parts Identification

Provide identification and coverage for all parts of each component and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components.

- A. Manufacturer's Standard Commercial Practice: The parts data may cover more than one model or series of equipment, components, attachments, or accessories, such as a master parts catalog, in accordance with the manufacturer's standard commercial practice.

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- B. Other Than Manufacturer's Standard Commercial Practice (MSCP): End item manufacturer may add a cross-reference to implement components' assemblies and parts requirements when implementation in manual form varies significantly from the style, format, and method of manufacturer's standard commercial practice. Use the format in the following example:

End Item Manufacturer's Alphanumeric Sequence	Actual Manufacturer's Name and MSCP	Actual Manufacturer Part No.
100001	John Doe & Co. 00000	2000002

1.2.4.2 Warranty Information

List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force.

1.2.4.3 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.3 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:

1.3.1 Data Package

- A. Safety precautions
- B. Normal operations
- C. Environmental conditions
- D. Preventive maintenance plan and schedule
- E. Troubleshooting guides and diagnostic techniques
- F. Wiring diagrams and control diagrams
- G. Maintenance and repair procedures
- H. Removal and replacement instructions



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- I. Spare parts and supply list
- J. Parts identification
- K. Warranty information
- L. Testing equipment and special tool information

**PART 2 PRODUCTS**

(Not Used)

**PART 3 EXECUTION**

(Not Used)

**END OF SECTION**

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## SECTION 16100 ELECTRICAL INSTALLATION

### PART 1 GENERAL

#### 1.1 SUMMARY

- 1.1.1 Furnish all labor, material, tools, and equipment necessary to perform installation of area security lighting as shown on the contract drawings and in accordance with the requirements of this specification.
- 1.1.2 Seller shall be responsible for field routing and/or matching of equipment wiring and conduit to components where not specifically defined on the contract drawings.

#### 1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

##### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70                      1990 National Electrical Code (NEC)

#### 1.3 RELATED REQUIREMENTS

Specification Section 16110    Electrical Materials and Devices  
Specification Section 16905    Electrical Testing

#### 1.4 SYSTEM DESCRIPTION

The new area security lighting shall consist of 480V low pressure sodium luminaires mounted on steel poles fed with direct burial cable.

#### 1.5 SUBMITTALS

- 1.5.1 Submit the following in accordance with Part III, Section I, Exhibit 5 of the Purchase Order/Subcontract, Vendor Drawing and Data Requirements (VDDR).
  - 1.5.2 Manufacturer's instructions for installation of poles, luminaires and other miscellaneous items identified in this specification and as shown on the contract drawings. Manufacturer's instructions

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shall include connection diagrams and additional procedures for equipment storage, handling, protection, examination, preparation and start-up.

**1.6 PROJECT OR SITE ENVIRONMENTAL CONDITIONS**

**1.6.1 Climatic and Geographic Site Conditions**

- A. Site Elevation 714 feet above sea level
- B. Barometric Pressure 14.3 psia
- C. Outside Design Temperature
  - 1) Maximum Design Temperature 110°F
  - 2) Minimum Design Temperature -20°F

**1.6.2 Operating Environment**

- A. Normal Temperature -20° to 110°F

**PART 2 PRODUCTS**

**2.1 MATERIALS AND/OR EQUIPMENT**

Furnish all materials and equipment required to perform installation work in accordance with the contract drawings and Specification Sections 16110, Electrical Materials and Devices.

**PART 3 EXECUTION**

**3.1 INSTALLATION, APPLICATION AND ERECTION**

**3.1.1** Equipment and materials shall be installed in accordance with the contract drawings and manufacturer's instructions furnished with equipment and materials. Installation shall conform with the National Electrical Code.

**3.1.2 Fastenings**

**3.1.2.1** Unless noted otherwise on contract drawings, fastenings to steel shall be by means of machine screws, bolts or certified and/or Buyer approved welding method. No wood or fiber plugs shall be permitted.

**3.1.2.2** Seller shall drill, tap, or weld to structural steel as required to mount equipment and material.

- 3.1.2.3 Seller shall supply and install electrical supports where structural supports cannot be used or are not available.
- 3.1.3 Grounding
- 3.1.3.1 The grounding of electrical equipment, grounded electrical circuits, etc., shall be in accordance with the contract drawings. In addition to the grounding specified herein or on the contract drawings, all ground connections required by the NEC shall be furnished and installed. Where grounding conductor sizes are not indicated on the contract drawings, the minimum requirements of the National Electrical Code shall apply.
- 3.1.3.2 Before connections are made, all contact surfaces shall be clean of grease, dirt and debris.
- 3.1.3.3 Apply an anti-oxidizing compound per Specification Section 16110, Electrical material and Devices, to clean contact surfaces for pressure or clamp-on type ground connections.
- 3.1.4 Lighting System
- 3.1.4.1 Lighting fixtures shall be installed at locations shown on the contract drawings.
- 3.1.4.2 Route lighting circuits underground with direct buried cable. Cable shall be protected with 1 by 8 inch wood boards as shown on contract drawings.
- 3.1.4.3 Install marking tape within backfill above wood board(s) as shown on the contract drawings.
- 3.1.4.4 Circuits routed underground below railroad tracks and roadways shall be in concrete encased PVC conduit as shown on contract drawings. Minimum concrete encasement shall be 3 inches all around.
- 3.1.4.5 Seal conduit openings to prevent moisture from entering conduits in accordance with manufacturer's instructions.
- 3.1.4.6 Splices in direct burial cable shall be made in light pole hand-holes or precast concrete pullboxes only as shown on contract drawings and in accordance with manufacturer's instructions.
- 3.1.4.7 Light poles shall be installed plumb. Use shims or double nuts to adjust plumb. Grout under each light pole base after adjusting for plumb, as shown on contract drawings.
- 3.1.4.8 Fixture fastenings and supports shall be firmly set so that the fixtures will not be distorted by handling during normal maintenance.

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**3.2 FIELD QUALITY CONTROL**

Electrical materials and lighting equipment shall be inspected and tested in accordance with Specification Section 16905, Electrical Testing.

**3.3 CLEANING**

**3.3.1** Clean and remove all debris, excess material and equipment from the job site after completion of installation.

**3.3.2** Clean electrical parts to remove conductive and deleterious materials. Remove dirt and debris from enclosures.

**3.3.3** Clean photometric control surfaces as recommended by the manufacturer.

**3.4 PROTECTION**

During installation operations, protect from damage, all existing facilities, equipment and materials. Existing facilities, equipment or materials which are damaged during the installation operations, shall be repaired at Seller's expense in accordance with Contract Terms and Conditions.

**END OF SECTION**

**SECTION 16110  
ELECTRICAL MATERIALS AND DEVICES**

**PART 1 GENERAL**

**1.1 SUMMARY**

This specification covers the technical requirements for furnishing and delivery of electrical equipment, materials and devices for the area security lighting.

**1.2 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

**AMERICAN ASSOCIATION OF STATE HIGHWAY AND  
TRANSPORTATION OFFICIALS (AASHTO)**

AASHTO LTS2 DIVISION I 11.4	1985 Structural Supports for Signs, Luminaires and Traffic Signals
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**AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)**

ANSI C78.41	1987 Electric Lamps - Low Pressure Sodium Lamps
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ANSI C82.9	1988 High Intensity Discharge and Low Pressure Sodium Lamps, Ballasts, and Transformers - Definitions
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**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM A36	1990 Standard Specification for Structural Steel
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ASTM A153	1982 (R 1987) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
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ASTM A307	1990 Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
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ASTM A500	1990 Standard Specification for Cold- Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
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ASTM B3                      1974 (R85) Standard Specification for Soft  
or Annealed Copper Wire

ASTM B8                      1986 Standard Specification for  
Concentric-Lay-Stranded Copper Conductors,  
Hard, Medium-Hard, or Soft

FEDERAL SPECIFICATIONS (FS)

FS-TT-P-645                1990 Primer, Paint, Zinc-Molybdate Alkyd  
Type

FS-595A                    1985 Medium Gray Gloss Enamel Paint  
(Change Notice No. 9)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA WC7                   1988 Cross-Linked-Thermosetting-  
Polyethylene-Insulated Wire and Cable  
for the Transmission and Distribution  
of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70                    1990 National Electrical Code (NEC)

UNDERWRITERS LABORATORIES (UL)

UL 44                      1983 Rubber Insulated Wires and Cables,  
Twelfth Edition

UL 510                    1986 Insulating Tape, Sixth Edition

UL 651                    1989 Schedule 40 and 80 Rigid PVC Conduit,  
Fifth Edition

UL 1277                   1989 Electrical Power and Control Tray  
Cables with Optional Optical-Fiber  
Members, Second Edition

UL 1581                   1983 Reference Standard for Electrical  
Wires, Cables and Flexible Cords

1.3

RELATED REQUIREMENTS

Specification Section 01730    Operation and Maintenance Data

Specification Section 16100    Electrical Installation

Specification Section 16905    Electrical Testing

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1.4 SUBMITTALS

Submit the following in accordance with Part III, Section I, Exhibit 5 of the Purchase Order/Subcontract, Vendor Drawing and Data Requirements (VDDR).

1.4.1 Manufacturer's Catalog Data for the following:

- A. Splice kit
- B. Conduit
- C. Sealant
- D. Precast concrete pullbox
- E. Insulating tape
- F. Marking tape
- G. 600 Volt power cable
- H. Luminaires
- I. Lamps
- J. Ballasts
- K. Poles

1.4.2 Manufacturer's Drawings for the following:

- A. Precast concrete pullbox
- B. Luminaires

Include dimensions, effective projected area (EPA), accessories, and installation and construction details. Photometric data, including zonal lumen data, and candlepower distribution data.

- C. Poles

Include dimensions, wind load withstand capability and maximum pole deflection under maximum loading conditions in accordance with AASHTO LTS2.

- D. Anchor base and anchor bolt pattern details and criteria.

1.4.3 Manufacturer's Installation Instructions including application conditions and limitations



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- 1.4.4 Operation and maintenance data in accordance with Specification Section 01730, Operation and Maintenance Data.
- 1.4.5 Physical characteristics of the 600 volt power cable including the following:
  - A. Details of construction for each different type of wire and cable
  - B. Overall wire diameter
  - C. Insulation thickness (average minimum and average maximum)
  - D. Thickness and color of jacket
  - E. Insulation type
- 1.4.6 A copy of the UL listing cards certifying that the power cable is in compliance with the UL standard referenced in this specification.
- 1.5 **PROJECT OR SITE ENVIRONMENTAL CONDITIONS**
  - 1.5.1 Climatic and Geographic Site Conditions
    - A. Site Elevation 714 feet above sea level
    - B. Barometric Pressure 14.3 psia
    - C. Outside Design Temperature
      - 1) Maximum Design Temperature 110°F
      - 2) Minimum Design Temperature -20°F
  - 1.5.2 Operating Environment
    - A. Normal Temperature -20° to 110°F

## **PART 2 PRODUCTS**

### **2.1 MATERIALS AND EQUIPMENT**

#### **2.1.1 Splice Kit**

Splice kits for 600 volt direct buried cable shall be waterproof, Plymouth Plyflex Low Voltage Splice Kit or equal.

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2.1.2 PVC Conduit

PVC conduit shall be Schedule 40 or Schedule 80 as shown on the contract drawings in accordance with UL 651.

2.1.3 Sealant

Sealant for preventing moisture from entering conduits shall be a non-oxidizing and noncorrosive compound, Dow Corning 738 or equal.

2.1.4 Pullboxes

Pullboxes shall be precast concrete type with bolt down concrete cover and no base. Brooks Products 36 PBC-1 Series or equal.

2.1.5 Tapes

2.1.5.1 Insulating Tape

Insulating tape shall be vinyl insulating type with a continuous temperature rating of 105°C, in accordance with UL 510. 3M Super 88 Series or equal.

2.1.5.2 Marking Tape

Plastic marking tape for identifying underground electrical cable shall be six inches wide, yellow color, without printing. Reef Industries Terra Tape or equal.

2.1.6 Wood Boards

Boards for protecting underground direct buried cable(s) shall be preservative treated, one inch thick by eight inches wide (nominal).

2.1.7 600 Volt Power Cable

2.1.7.1 General Requirements

2.1.7.1.1 Cable supplied shall be new, shall be the product of an established manufacturer normally engaged in the production of cable, with a minimum of 5 years documented experience in the manufacture of this type cable.

2.1.7.1.2 Cable on each reel shall be continuous. Factory splices or factory repaired cable are not acceptable in individual conductors. Cable shall be free of abrasions and/or abnormalities.

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## 2.1.7.2 Single Conductor Cable

### 2.1.7.2.1 Design Requirements

Cables herein specified shall be rated 600 volts, Type XHHW in accordance with National Electrical Code, NFPA-70, Article 310 and UL 44. The maximum continuous conductor temperature shall be 90°C for dry and 75°C for wet location. Okonite X-0lene Type XHHW or equal.

Number 12 AWG conductors shall be solid.

### 2.1.7.2.2 Conductor

Conductors shall be uncoated, soft or annealed, bare copper wire in accordance with ASTM B3.

### 2.1.7.2.3 Conductor Insulation

The insulation shall be flame-retardant, heat and moisture resistant type of cross-linked-polyethylene compound. The insulation shall be in accordance with Part 3 of NEMA WC7.

Nominal insulation thickness and maximum wire diameter shall be as follows:

<u>Conductor Size (AWG)</u>	<u>Insulation Thickness Mils</u>	<u>Maximum Wire O.D. Inches</u>
12	30	0.15

## 2.1.7.3 Multiconductor Direct Burial Cable

### 2.1.7.3.1 Design Requirements

All cables shall have a 600 volt rating. They shall be Type TC multiconductor cable suitable for direct burial in accordance with National Electrical Code Articles 340 and 310, UL 1277 and UL 1581. All cables shall include an insulated ground wire. Okonite X-0lene-Okoseal Type TC cable or equal.

### 2.1.7.3.2 Conductor

Conductors shall be uncoated, soft or annealed, bare copper wire in accordance with ASTM B3 and shall be Class B, concentric stranded in accordance with Part 2 of NEMA WC7 and ASTM B8.

#### 2.1.7.3.3 Conductor Insulation

The conductor insulation shall be flame-retardant, cross-linked-polyethylene compound, type XHHW in accordance with NEMA WC7 and UL 44.

Nominal insulation thickness and maximum wire diameter shall be as follows:

<u>Conductor Size (AWG)</u>	<u>Number of Conductors</u>	<u>Insulation Thickness Mils</u>	<u>Grdg Cond Size (AWG)</u>	<u>Maximum Cable O.D. Inches</u>
12	4	30	1# 12	.49
10	4	30	1# 10	.58
8	4	45	1# 8	.72

#### 2.1.7.3.4 Jacket

Cable shall have an overall flame retardant, gas vapor tight, black chlorinated polyethylene jacket extruded over it.

#### 2.1.8 Lighting Equipment and Material

##### 2.1.8.1 General Requirements

The pole, luminaire, anchor base, anchor bolts and bracket arm shall be an integral assembly designed in accordance with the standards specified in this Section. The pole assembly complete with luminaire in place, shall be capable of withstanding a sustained wind velocity of 70 mph with gust wind velocity of 1.3 times the sustained wind velocity in accordance with AASHTO DIVISION I 11.4.

##### 2.1.8.2 Luminaire

Luminaire shall be low pressure sodium, one lamp, 180 watt, 480V, single phase, pole mounted type, with clear flat lens, dual in-line fuses and individual photocell control.

Housing shall be constructed of formed and welded aluminum sheet with integral high power factor ballast in accordance with ANSI C82.9, rated for -20°F starting, enclosed and gasketed suitable for outdoor use. Each housing shall be finished with a zinc-molybdate primer coat, alkyd type, conforming to Federal Specification FS-TT-P-645, and painted with a medium gray coat paint, pigmented alkyd gloss enamel conforming to Federal Specification FS-595A. Spaulding Palomar LPS Series or equal.

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2.1.8.3 Lamps

Low-pressure sodium (LPS) lamps shall meet ANSI standard C78.41 for 180 watt lamp type L74. Venture lighting Pro-Arc #76415 or equal.

2.1.8.4 Poles

2.1.8.4.1 Pole shall include shaft, anchor base, handhole with cover, base cover, anchor bolts, leveling shims and tenon for mounting two foot side arm with two inch slipfitter. Pole finish shall match luminaire. Spaulding 30 foot, square, straight steel pole or equal.

2.1.8.4.2 Pole shaft shall consist of one piece square steel tubing possessing a minimum yield strength of 46,000 psi per ASTM A500, Grade B. The shaft shall have a handhole, handhole cover and a terminal for grounding, accessible from the handhole in accordance with National Electrical Code, NFPA 70, Article 410-15. The pole shaft top shall be prepared to accept the specified luminaire and bracket arm.

2.1.8.4.3 Anchor base shall be circumferentially welded to the pole shaft. The capacity of the weld attaching the shaft to the base shall exceed the tensile capacity of the shaft. The base shall be fabricated from ASTM A36 steel and having a minimum yield strength of 36,000 psi.

2.1.8.4.4 Two foot side arm with two inch slipfitter to match pole top tenon. An opening in the tenon mounting plate shall be part of the continuous wireway from the pole base to the luminaire. Bracket arm primer and paint shall match pole shaft and luminaire finishes. Bracket arm shall be furnished with nuts and bolts required for mounting luminaire.

2.1.8.4.5 Anchor bolts shall be heavy hex head bolts fabricated from ASTM A36 or A307 Grade C steel. Anchor bolts and hex nuts shall be galvanized per ASTM A153.

2.2 **FABRICATION AND MANUFACTURE**

2.2.1 600 Volt Power Cable

2.2.1.1 Surface Marking

The surface of the insulation shall have a durable marking, at intervals not exceeding 24 inches, which shall consist of: manufacturer's name, trademark, or other distinctive marking which identifies the organization responsible for the product; the type letters (TC); the wire size in AWG; maximum voltage (600 volts); and UL marking.

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2.2.1.2 Conductor Identification

Conductors shall be color coded by pigmented insulation as indicated below:

- A. Grounded neutral - Gray
- B. Grounding conductor - Green
- C. Phase "A" conductor - Brown
- D. Phase "B" conductor - Orange
- E. Phase "C" conductor - Yellow

2.2.1.3 Packaging

Watertight seals shall be applied to the ends of the wire to prevent entrance of moisture during transit or storage.

**PART 3 EXECUTION**

**3.1 INSTALLATION, APPLICATION AND ERECTION**

Installation of electrical material and lighting system equipment shall be in accordance with Specification Section 16100, Electrical Installation.

**3.2 FIELD QUALITY CONTROL**

Electrical materials and lighting system equipment shall be inspected and tested in accordance with Specification Section 16905, Electrical Testing.

**END OF SECTION**

**SECTION 16905  
ELECTRICAL TESTING**

**PART 1 GENERAL**

**1.1 SUMMARY**

1.1.1 This section of the specification sets forth the electrical testing and inspection procedures required for the acceptance of electrical components and/or systems as described in the paragraphs that follow.

1.1.2 The purpose of the specified tests and inspections is to determine that each component is in compliance with the drawings and specifications.

1.1.3 It is the intent of these procedures to ensure that all workmanship, materials and the manner and method of erection and installation conform to manufacturer's instructions and the drawings and specifications.

1.1.4 The Seller shall perform and supervise all tests unless specifically noted otherwise herein or on the contract drawings. The Seller shall furnish all test equipment required for the tests performed by him and shall be responsible for providing such safety measures as are required for each test.

**1.2 REFERENCES**

**INTERNATIONAL ELECTRICAL TESTING ASSOCIATION**

ATS 1991 Acceptance Testing Specifications

**1.3 RELATED REQUIREMENTS**

Specification Section 16100 Electrical Installation

**1.4 SYSTEM DESCRIPTION**

The new fence lighting consists of 480 volt low pressure sodium luminaires mounted on steel poles fed with direct burial cable.

**1.5 SUBMITTALS**

Submit the following in accordance with Part III, Section I, Exhibit 5 of the Purchase Order/Subcontract, Vendor Drawing and Data Requirements (VDDR).

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- 1.5.1 Written procedures for all inspection and testing to be performed.
- 1.5.2 Inspection reports for underground cable installation.
- 1.5.3 Inspection reports for lighting systems.
- 1.5.4 Test and inspection reports for cables and wires.
- 1.5.5 Calibration and Testing Equipment Standards

The Seller shall submit to the Buyer for approval, a complete listing of proposed calibrating and testing equipment, including calibration standards with current certification from the National Institute of Standards and Technology. Seller has the option of using equipment in his possession with valid National Institute of Standards and Technology Certification of equipment, or can use the service of a testing lab with valid National Bureau of Standards Certification of equipment.

## 1.6 PROJECT OR SITE ENVIRONMENTAL CONDITIONS

### 1.6.1 Climatic and Geographic Site Conditions

- A. Site Elevation 714 feet above sea level
- B. Barometric Pressure 14.3 psia
- C. Outside Design Temperature
  - 1) Maximum Design Temperature 110°F
  - 2) Minimum Design Temperature -20°F

### 1.6.2 Operating Environment

- A. Normal Temperature -20° to 110°F

## PART 2 PRODUCTS

### 2.1 MATERIALS AND/OR EQUIPMENT

- 2.1.1 Furnish all materials and equipment required to perform inspection and testing in accordance with this specification.
- 2.1.2 All equipment used for testing shall be calibrated within six months prior to testing, and Seller shall provide proof of calibration traceable to National Institute of Standards and Technology requirements.



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- 2.1.3 All calibrating and testing equipment must be checked every six months, except idle equipment which must be calibrated prior to usage, to the standards for the project, and certified as being accurate. Certified shall mean affixing a label stating that the equipment has been checked against the standard for the project, for accuracy, dated and initialed by the certifier. The calibration results must be logged and available to the Buyer for inspection.
- 2.1.4 Any equipment failing the standards test must not be used until repaired and re-standardized. All calibrating and testing equipment shall have valid certified label affixed to the equipment during usage. The label shall be affixed in a prominent location. The Buyer can, at his discretion, require the calibrating and testing equipment to be checked to the standards. Standards must not be used as calibration and testing devices in the field.
- 2.1.5 The Seller shall be required, every six months, to check the standards for the project to calibration standards with current certification from the national Bureau of Standards.
- 2.1.6 Seller shall be responsible for ensuring that the accuracy of the testing equipment is equal to (or better) than the accuracy of the equipment to be calibrated/tested.
- 2.1.7 Seller shall maintain a calibration log showing date, location, name of lab (if applicable), certification number and name of certifier. Log must be kept current and available to the Buyer for inspection.

### **PART 3 EXECUTION**

#### **3.1 PREPARATION**

- 3.1.1 The Seller shall notify the Buyer at least 24 hours prior to test, advising him of the test to be performed, and the scheduled date and time of test.
- 3.1.2 Seller shall submit all test procedures to Buyer for approval prior to testing.
- 3.1.3 All test voltages listed in this specification shall be checked against manufacturer's instructions and adjusted as applicable.

#### **3.2 INSTALLATION, APPLICATION AND ERECTION**

Refer to Specification Section 16100, Electrical Installation.

### 3.3 FIELD QUALITY CONTROL

#### 3.3.1 General

3.3.1.1 All wiring and connections shall be tested for continuity before fixtures, devices and equipment are connected.

3.3.1.2 In the event that any test or portion of any test reveals unsatisfactory performance, the Seller shall be responsible for resolving any deficiencies and retesting until satisfactory performance is achieved.

#### 3.3.2 Inspection

3.3.2.1 The Seller shall visually inspect the installation to verify conformance to this specification and the contract drawings. This inspection shall take into consideration, for example: proper equipment and conductor identification, verification of completeness, accurate placement, proper attachment to supports and tightness of connection.

#### 3.3.3 Wire and Cable Tests

##### 3.3.3.1 Continuity Test

A. Test for continuity, correctness of wiring and verify correct identification on all conductors installed.

B. Tests shall be made with an ohmmeter.

##### 3.3.3.2 Insulation Resistance Test

A. All conductors shall be given an insulation resistance test using a megohmmeter.

B. Test shall be made with the conductors disconnected at the equipment. Test shall be made between one conductor and ground with the other conductors grounded. Each conductor shall be tested in the same manner. The voltage shall be applied and readings taken every minute until three equal and consecutive readings are obtained.

C. Disconnected wires shall be safety tagged. Disconnect devices (circuit breakers, switches, etc.) shall be safety tagged and locked open.

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- D. Test voltages and minimum acceptable insulation resistance shall be as follows:

<u>Insulation Voltage</u>	<u>Test Voltage</u>	<u>Min. Insulation Resistance</u>
600 volt ac	1000 Vdc	10 megohms

- 3.3.3.3 Test reports shall be submitted to Buyer.

- 3.3.4 Operation Tests

Upon completion of work, the Seller shall demonstrate the operation of all electrical components and/or systems.

- 3.4 **CLEANING**

Clean and remove all debris and equipment from the job site after completion of testing.

END OF SECTION